



THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF APPEALS

Application of:
JOSEPH B. KEJHA, DAVID CHUA, HSIU-PING LIN
Serial No.: 09/911,036
Filed: July 23, 2001
Title: Manufacturing Method and Structures of Electrodes
For Lithium Based Electrochemical Devices

Examiner: Keith Walker
Art Unit: 1745

January 27, 2008

APPEAL BRIEF

This is an appeal from the final rejection of the Examiner dated June 1, 2007 rejecting claims 5-8, 10-14, 21-23 and 28-31, being all the rejected claims in the Application. This brief is accompanied by the fee set forth in Section 41.20 (b) (2).

REAL PARTY OF INTEREST

Real party of interest are the three inventors stated on the Application:

JOSEPH B. KEJHA, DAVID CHUA AND HSIU-PING LIN.

RELATED APPEALS AND INTERFERENCES

There are no prior and pending appeals, interferences or judicial proceedings known to appellants.

STATUS OF CLAIMS

This Application was filed on July 23, 2001, which is related to a prior co-pending Disclosure Document of Joseph B. Kejha, Serial No. 490,150 filed on March 8, 2001.

A Continuation of this Application # 10/119,220 was filed on April 4, 2002, now abandoned. Divisional Application # 11/332,817 was filed on January 13, 2006 ; and a Continuation of Application # 11/378,973 was filed on March 18, 2006.

In an Amendment on February 17, 2005 claim 1-4 have been cancelled and rewritten as new claim 24-27.

In an Amendment on August 29, 2005 claims 24-27 have been cancelled and rewritten as new claims 28-31.

In an Amendment on March 24, 2006 applicants filed Request for Continued Examination and claims 9 and 15-20, have been cancelled.

Claims 5-8, 10-14, 21-23 and 28-31 in this Application were rejected on December 12, 2006, and an Amendment was filed on March 12, 2007, which Amended claims 14 and 23 and 28-31.

All remaining claims are dependent on claims 28-31.

Claims 5-8, 10-14, 21-23, and 28-31 were finally rejected on June 1, 2007.

On December 1, 2007 Applicants sent the Notice of Appeal to the Board of Appeals, with proper fees, including the Petition for Extension of Time.

The status of the claims is as follows:

Claims allowed: none

Claims cancelled: 1-4, 9, 15-20, 24-27.

Claim objected to: none

Claims rejected: 5-8, 10-14, 21-23 and 28-31.

Claims pending: 5-8, 10-14, 21-23 and 28-31.

Claims 28-31 were rejected under 35 U.S.C. Section 103 (a) as obvious over

Kejha No. 5,443,602, Brownrigg No. 3,607,411, Chesnut No. 4,033,522.

Claims 5-8, 10, 11, 21 and 22 were rejected under 35 U.S.C. Section 103(a) as obvious over Kejha No. 5,443,602, Brownrigg No. 3,607,411, Chesnut No. 4,033,522 and Andersen No. 6,280,879.

Claims 14 and 23 were rejected under 35 U.S.C. Section 103(a) as obvious over Kejha No. 5,443,602, Brownrigg No. 3,607, 411, Chesnut No. 4,033,522, Andersen No. 6,280,879 and Werner No. 3,694,392.

Claims 12 and 13 were rejected under 35 U.S.C. Section 103(a) as obvious over Kejha No. 5,443,602, Brownrigg No. 3,607,411, Chesnut No. 4,033,522 and

Iwanaga No. 5,385,761.

Applicants appeal the final rejection of claims 5-8, 10-14, 21-23, and 28-31.

STATUS OF AMENDMENTS

All Amendments have been entered.

SUMMARY OF CLAIMED SUBJECT MATTER

Applicants' invention is directed to uniform coating thickness of electrodes for electrochemical devices:

Prior art electrodes for lithium batteries have an active material with a binder, coated as a layer on one side (or on the top) of a substrate or current collector, such as metal foil, or in some instances the electrode material is coated on a plastic carrier film as a layer, which is then later peeled-off and pressed onto a metal grid or expanded foil. Another method employs fibrous web, such as carbon fiber woven or non-woven fabric, or metalized

plastic fabric coated with, or embedded-in the active material, which fabric may be then pressed onto a metal grid or expanded foil current collector, or a metal foil terminal, or vice-versa, as described in the US Patent #6,080,267. Prior art U.S. Patent #5,587,253 discloses an electrode which also has an embedded grid in the middle by pressing two electrode films onto both sides of the grid. Although these methods are adequate for certain applications, all of them are costly, labor intensive and difficult, or have size limitations due to non-uniform coating thickness. The pressed-on foils, or grid current collectors often separate, or do not adhere well to the electrode layer, thus causing reliability or low conductivity problems.

Prior art methods to coat electrode material directly on metal grids have been unsuccessful, or partially successful, such as the method described by Kejha in the US. Patent #5,603,442.

It has now been found, that the electrodes for lithium batteries, such as lithium polymer, lithium-ion and lithium-ion-polymer batteries, and other electrochemical devices can be easily made by dip-coating electrode active materials in the form of a slurry, directly on expanded foils, or metal grids, or perforated metal foils, or even solid metal foils, which are preferably specially treated, and then this dip-coating is to solidify by solvents evaporation, drying, heating, cross-linking, radiation, or other well know methods. The active material's slurries may comprise an active material, such as various oxides, lithiated oxides, halides, sulfites, etc., or graphite, or mesocarbon microbeads (MCMB), and a carbon black, and a polymer binder, such as polyvinylidene fluoride (PVDF) homopolymer, and a solvent, and preferably a mixture of at least two solvents, such as acetone (AC) and N-methylpyrrolidinone (NMP). The NMP dissolves the PVDF homopolymer, and the AC controls the viscosity of the slurry and evaporates rapidly after coating, which causes solidification of the coating. The NMP is then evaporated by increasing the heat. Preferably, there are no plasticizers in the slurry. The solidification of the

coating causes it to be attached to the grids or various foils. The dip-coating provides for an electrode with the grid, or expanded, or perforated foil, or solid foil, as a current collector, and a coating carrier being embedded in the middle of the uniform thickness coating of unlimited width, which is very beneficial for electrical current collection, due to the shorter travel distance of the electrons through the thickness of the electrode. This method also makes possible the manufacture of large cells. Porousness or openness of the grids also provides for ionic access to the active material on both sides of the grid. The solid foil is useful as a current collector in the middle of bi-cells. The viscosity of the slurry and the uniform, constant speed of the carrier grid through the slurry controls the thickness of the coating and provides for uniform thickness of the coating at any width and length of the grid, or other carriers. The grid web length is pulled from a spool by nip-rollers driven by an adjustable but constant speed motor, which controls the speed of the web before coating. The grid length is then pulled over rollers through a dip-tank containing the slurry vertically upward and then is wound onto a spool, driven by second motor with a slip clutch to keep the web in tension.

The slurry should be continuously mixed during coating to prevent settling of particles. It has also been found that success of the dip-coating and its adhesion to the grid or various foils, and its low electrical resistance also depends on the treatment or priming of the grids or foils, prior to dip-coating by active materials. The preferred treatment of the aluminum grid, which is usually used in cathodes of lithium ion cells, or electrodes of capacitors is a water based primer comprising a mixture of a solution of lithium polysilicate and carbon black in distilled water, and may be applied also by dip-coating and drying, or by other methods. After treatment, the grid is baked to remove the water. This primer is not dissolved or does not wash off by the slurry solvents, and the carbon black makes it electrically conductive. The preferred treatment of the copper or other metal grid, which may be used in a lithium-ion cell's anode is made preferably by dip-coating a

mixture of carbon black and a thin solution of PVDF homopolymer in at least two solvents, such as AC and NMP, onto the grid. After the AC evaporation, the grid is baked in air or vacuum to remove the NMP and thus attach the PVDF homopolymer to the metal. This primer also does not wash off during the later coating of electrode materials.

The described structures are also useful in electrodes of various electrochemical devices, such as capacitors and supercapacitors.

Another embodiment of this invention is, that the grids or various foils to be ultrasonically welded or otherwise attached later in the cells can be masked in the weld attachment area by solvent resistant tapes, which are not too adhesive, so that they can be easily peeled-off after coating. The masking tapes prevent the treatment and electrode coating of the grid (or various foils) in the area of the intended weld/attachment, referred to as the terminal tab. The tapes are then removed, preferably before cutting of electrode leafs from the coated electrode length.

Another embodiment of this invention is, that the grids or various foils can be cleaned in the intended area of the terminal tab and the electrode material coatings can be removed by sand blasting or buffing and vacuuming out the loose particles, while using a template shield to protect the active area coating of the electrode. A length of coated electrode is simply pulled through a sand blasting or buffing machine, creating for example, cleaned uncoated strips of the grid at the sides of the electrode length. The sides may be later notched to create terminal tabs.

Preferred embodiments of the invention are illustrated in the following example :

Referring now in more detail, particularly to the drawings of this patent and Figure 1, one embodiment of this invention utilizes a simple vertical dip-coating method of the electrode active materials directly on the metal grids, or expanded foils, or perforated foils, or solid foils by the dip-coating machine, which may be well known in principle, but modified dip-coater for production of composite printed circuit boards. For example, the coater 1 includes base 2, which has attached to it feed spool support 3 with spool 4. The spool 4 may have wound on it a length of metal grid 5, having a desirable width, and this grid length is fed into nip rollers 5A, driven by variable speed motor 5B, mounted on support 5C, and then the grid 5 travels through the dip-tank 6 over the rollers 7 and 8, which are supported by rack 9A. Motor 5B controls the speed of the grid 5. The dip-tank 6 contains an electrode slurry 9, which may include an active electrode material, such as a lithiated oxide or graphite powder, or mesocarbon microbeads (MCMB), a carbon black, such as Super-P (Eurachem, Belgium), a polymer binder, such as polyvinylidene fluoride (PVDF) homopolymer, and a solvent and preferably, a mixture of at of at least two solvents, such as acetone (AC) and N-methylpyrrolidinone (NMP). Other solvents may be tetrahydrofuran (THF) and dimethylformamide (DMF). For example, the NMP dissolves the PVDF homopolymer and the amount of AC controls the viscosity of the slurry. The PVDF homopolymer binder makes possible higher loading of electrodes with active materials, because less of this binder is needed, as opposed to prior art PVDF copolymer. Other components can be added into the slurry. The slurry 9 may be replenished from the tank 10 by opening the valve 11, which may be automated. Both tanks 6 and 10 should have the slurry continuously mixed by pump 13 and mixer 12 to prevent the settling of particles. Preferably, there should be no plasticizers present in the slurry. The grid length 5 is then pulled vertically upward over the roller 8 and through solidification chamber 15, which may be an infrared heat dryer with an air flow through it to remove the solvents by blowers 15A. The slurry coating on the grid 5 may be solidified by the solvent evaporation and especially by acetone evaporation, but other solidification

methods are possible, like UV or electron beam radiation curing, cross-linking etc.. The solvent evaporation is preferred. The NMP may be then dried out by increased heat, for example, from hot air blowers 16 and 16A. The grid coating must be solidified, at least on the surface, before touching the roller 14. The grid may then be optionally pulled over the roller 14 downward through an optional dryer 17, with blower(s) 17A and under roller 18. Additional heat may be applied for example, by additional hot air blowers (not shown), before the coated grid, and the electrode length 19 may be wound onto spool 20, which is driven by an adjustable but constant speed overdrive motor 20, with slip clutch 21A, to keep the grid 5 in tension. The spool 20, motor 21 and clutch 21A are mounted on the support 22. The support 22 is also attached to the base 2. All electrical components may be connected to control box 22B.

It should be noted that this vertical dip-coating is made possible by using a mixture of at least two solvents, and then by faster, but gentle evaporation of at least one lighter solvent, as not to create blisters, and by subsequent removal of the remaining solvents by additional heating. The solidification of the coating 22A makes it adhere to the grid 5, and because the grid 5 is embedded in the middle of the coating, it is a very beneficial electrode structure for less electrical resistance, due to shorter electron's travel distance to the collectors through the thickness of the electrode. This method provides superior conductivity as compared to the prior art embedding of the grid by pressing two layers of electrode films on it. Because the grid is porous, it also permits good access to the active material on both sides of the grid. The thickness of the coating is controlled by the viscosity of the slurry, and by the speed of the grid being pulled through the slurry. Various grid opening sizes and/or flattening of the grid also effects the "pick-up" and thickness. The solid metal foil may be useful as a current collector in the middle of bi-cells, or bi-polar capacitors.

Example of cathode electrode slurry mix by % (percent) range of weight is:

Lithiated cobalt oxide	24 to 37 %
carbon black	1.6 to 8 %
PVDF homopolymer	1.6 to 8%
NMP	6 to 18 %
Acetone	42 to 54 %

Example of cathode viscosity range is: 700 to 900 cp.

Example of cathode thickness range is: 3 to 16 mils +/- 2% to 5%, after solidification

Example of anode electrode slurry mix by % (percent) range of weight is:

MCMB	24 to 37 %
carbon black	1.0 to 5 %
PVDF homopolymer	1.6 to 8%
MNP	11 to 23%
Acetone	42 to 54%

Example of anode viscosity range is: 300 - 900 cp.

Example of anode thickness range is : 3 - 10 mils +/- 2% to 5%, after solidification

Example of the range of the speed of the grid carrier through the dip tank is:

3 - 7 feet/min. for both electrodes.

The preferred grid for lithium - ion cells is 1.5 mil thick, with diamond shaped openings size .031 inch, such as manufactured by Delker Corp., Branford, Conn.

This dip-coating method also provides for uniform thickness of the coating at unlimited width, and length. This method makes possible the manufacture of large cells.

This coating method is also applicable for manufacturing of electrodes for lithium polymer cells , prismatic liquid electrolyte lithium ion cells, or rolled liquid electrolyte lithium ion cells, hybrid lithium ion cells, lithium metal primary cells , and various capacitors like super capacitors, double layer capacitors, ultracapacitors, and many other electrochemical devices. The entire coater maybe also enclosed in a dry inert atmosphere box (not shown).

It has also been found that successful coating of the grid, or various foils, having low electrode resistance, also depends on the treatment, or priming of the grid, or foil, prior to coating with the active materials. It is assumed that the grids or foils are clean of oils or dirt, prior to priming. The grid, or foils, for cathode of lithium ion, or lithium ion-polymer cells is usually of aluminum metal, and the grid, or foil, for anode is usually of copper metal. The aluminum grid's preferred treatment may preferably be done by dip-coating in a water based primer, such as one comprising a solution of lithium-polysilicate and carbon black in distilled water. The carbon black makes it electrically conductive. The water is evaporated by heating above 100°C in air, and optionally later by vacuum drying. The water based primer does not dissolve in the slurry solvents later. The copper or other metal grid's preferred treatment may be done by simple dip-coating in 1% to 5% solution of PVDF homopolymer in a mixture of acetone and N-methylpyrrolidinone. A carbon black should also be added. After the acetone evaporation, the grid may be baked in the range of 220 C to 300°C for 2 sec. to 2 minutes in air, to remove the NMP, and later the grid may be vacuum dried. This treatment also does not wash-off by the slurry solvents later.

Example of the preferred aluminum grid primer mix by % (percent) weight range is:

Lithium polysilicate	4 to 8%
carbon black	0.5 to 2%
Distilled H ₂ O	90 to 95.5 %

Example of the preferred copper grid primer mix by % (percent) weight range is:

PVDF homopolymer	1 to 5%
carbon black	0.3 to 1.5 %
NMP	10 to 30 %
Acetone	63.5 to 88.7 %

Both primer grid treatments may be done by the similar dip-coater machine as for the electrode's active material coating, as shown in Figure 1, except the slurry 9 is replaced by the primer solution 39, as shown in Figure 7. However, for the water based aluminum grid primer, the coater may be modified as follows: Because the water based mixture tends to run-off fast, the aluminum grid length exiting from the dip-coating tank 6, should be immediately, after the exit from the solution, bent 90° over a roller 43 and may be horizontally pulled onto the spool 20, by-passing the top roller 14. Instead of the dryers 15 and 17, for example two hot air guns 40 and 41 on top and bottom of the grid may be applied, immediately after the 90° bend, to quickly evaporate the water and to dry the primer. This is another embodiment of the invention.

Referring now to Figures 2 and 3, another embodiment of this invention is illustrated. It was found, that the grids or various foils to be ultrasonically or otherwise welded, or electroconductively attached later in the cells can be masked in the intended weld/attachment area 23 by solvent resistant adhesive tapes 24, which are not too adhesive, so that they can be easily peeled-off after the coating, without destroying the foil or grid. The masking tapes prevent the primer and electrode coating 22A application on the grid (or various foils) 5 in the area of the intended weld/attachment, referred to also as the terminal tab 23A. The uncoated strips 23 may be optionally notched at lines 29 to create the terminal tabs 23A. The tapes 24 should be removed preferably before the cutting of the electrode leafs 25 from the coated electrode length 19 at the lines 26, 26A, 26B, and 27, and before notching at the lines 29. An example of the masking tape is the brown plastic (polypropylene) postal shipping tape.

The leafs 25 may be also cut in one step by use of any well known cutter.

Another embodiment of this invention is that the grids or various foils can also be cleaned after the coating without the tapes 24 in the intended area of the weld 23, or terminal tab 23A, and that the electrode material coatings 22A can be thus removed by sand blasting or buffing and vacuuming out the loose particles, while using a template shield (not shown) to protect the active area coating 28, (shaded area) of the electrode length 19. The length of coated electrode 19 may be simply pulled twice from the spool 20 through a sand blasting or buffing machine 32, as shown in Figure 6, creating for example uncoated (cleaned) strips 23 at the both sides of the electrode length 19. The strips 23 may later be optionally similarly notched at lines 29 to create terminal tabs 23A. For example, the machine 32 may have pressurized air 33 sucking sand 34 directed through nozzles 33A onto the electrode length 19. The sand may be then vacuumed out by a well known vacuum system's hose 35. Similarly, the buffing wheel 36 loosens the coating 22A, which may be then removed by vacuum hose 35A. The electrode length 19 may be flipped up side down between the pullings, in order to clean both sides. The cleaned length 19 is wound onto spool 20A and may be supported by table 38.

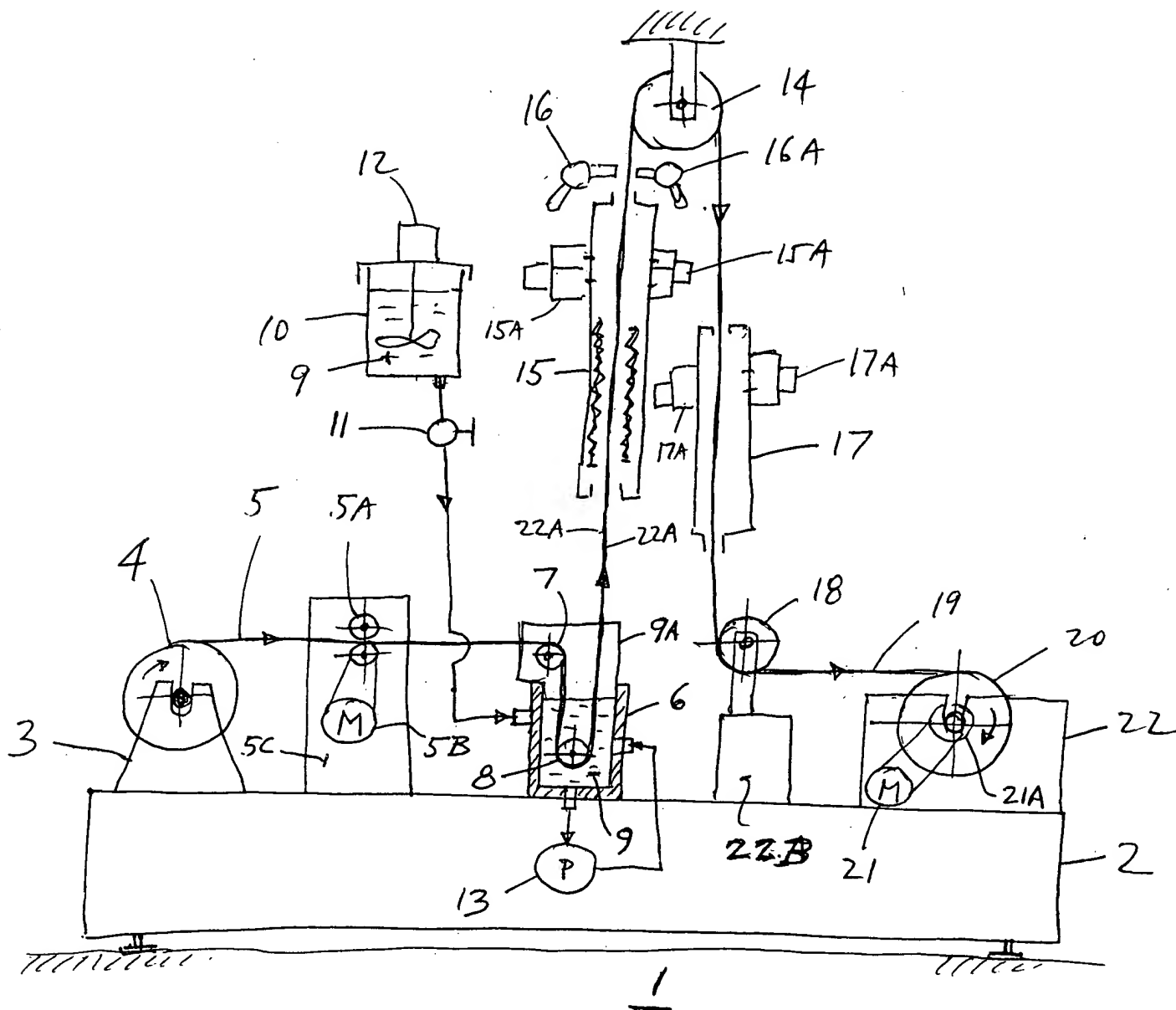


FIG. 1

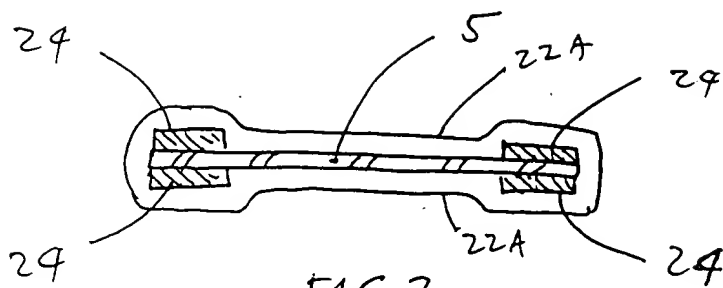


FIG. 3

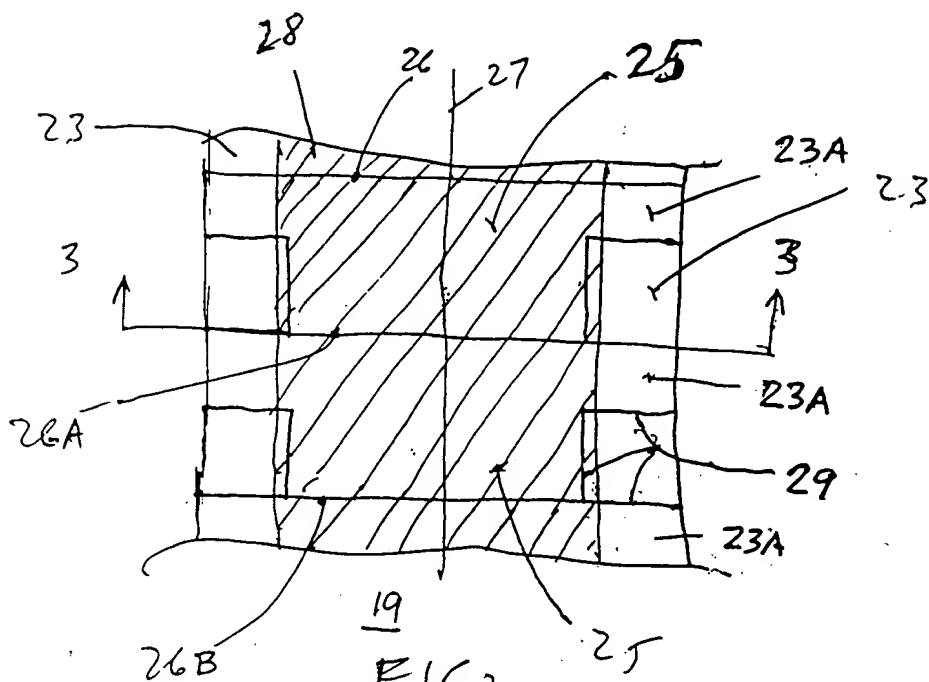


FIG. 2

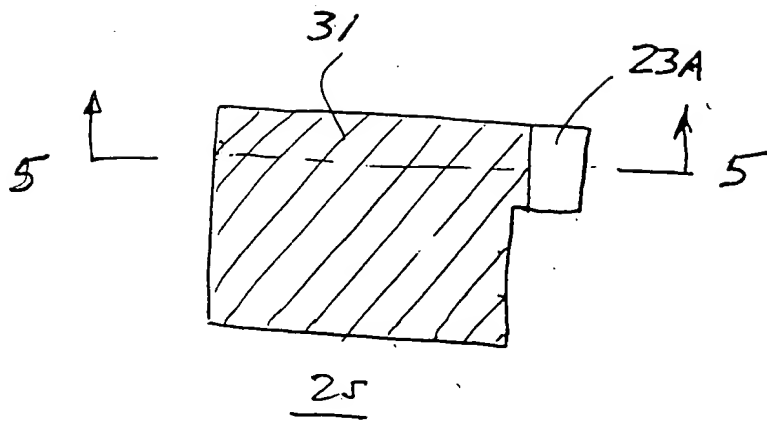


FIG. 4

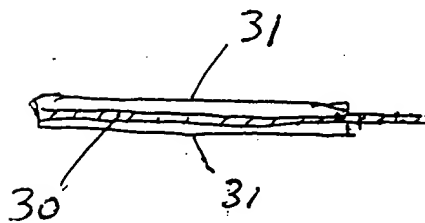


FIG. 5

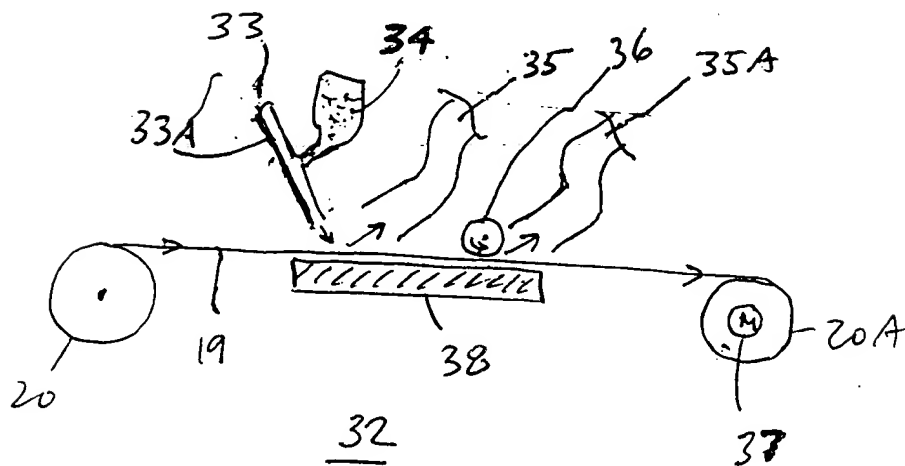
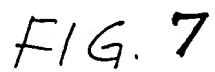


FIG. 6



ARGUMENT

The claims do not stand or fall together.

Claim 28 describes a manufacturing method of electrodes for lithium based electrochemical devices and capacitors comprising the sequential steps of: providing a length of a metal grid, feeding said length into a dip tank at controlled speed using driven nip-rollers before dip coating said length with an active material slurry pulling said length vertically upward through a solidification chamber, solidifying said length in said chamber, and winding said coated length onto a driven spool using an overdrive system with a slip clutch as shown in FIGURE 1 and is supported by the Specification (Page 9, lines 20-25 and Page 10, lines 1, 14-18, and 21-26).

Claim 29 describes a manufacturing method of electrodes for lithium based electrochemical devices and capacitors, comprising the sequential steps of providing length of an expanded metal foil, feeding said length into a dip-tank at a controlled speed using driven nip-rollers before dip-coating said length with an active material slurry, pulling said length vertically upward through a solidification chamber, solidifying said length in said chamber, and winding said coated length onto a driven spool using an overdrive system with a slip clutch, as shown in FIGURE 1 and is supported by Specification (Page 9, lines 16-25 and Page 10, lines 1, 14-18, and 21-26).

Claim 30 describes a manufacturing method of electrodes for lithium based electrochemical devices and capacitors, comprising the sequential steps of providing a length of a perforated metal foil, feeding said length into a dip-tank at a controlled speed

using driven nip-rollers before dip-coating said length with an active material slurry, pulling said length vertically upward through a solidification chamber, solidifying said length in said chamber, and winding said coated length onto a driven spool using an overdrive system with a slip clutch, as shown in FIGURE 1 and is supported by Specification (Page 9, lines 16-25 and Page 10, lines 1, 14-18, and 21-26).

Claim 31 describes a manufacturing method of electrodes for lithium based electrochemical devices and capacitors, comprising the sequential steps of providing a length of a solid metal foil, feeding said length into a dip-tank at a controlled speed using driven nip-rollers before dip-coating said length with an active material slurry, pulling said length vertically upward through a solidification chamber, solidifying said length in said chamber, and winding said coated length onto a driven spool using an overdrive system with a slip clutch, as shown in FIGURE 1 and is supported by Specification (Page 9, lines 16-25, and Page 10, lines 1, 14-18, and 21-26).

ISSUES FOR REVIEW

1. WAS THE EXAMINER'S REJECTION OF CLAIMS 28-31 UNDER 35 U.S.C. SECTION 103(a) AS OBVIOUS OVER KEJHA NO. 5,443,602; BROWNRIGG NO. 3,607,411; CHESNUT NO. 4,033,522 AND ANDERSEN NO. 6,280,879 IN ERROR?

The Examiner's rejection of claims 28-31 was in error.

The Examiner's position is that:

Claims 28-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 5,443,602 (Kejha) in view of US Patent 3,607,411 (Brownrigg) and US Patent 4,033,522 (Chesnut).

Kejha discloses a method of coating a current collector grid with cathode material so that the grid is embedded in the middle of the coating (Fig. 4; 2:5-7, 4:31-60). As shown in Fig. 4, a web (11), which may be a "desired current collector," travels into a dip tank (37) and vertically upward through a solidification chamber (43) using nip rollers (3:50-55; 4:46-56; 6:4-5). The speed of all the components of the manufacturing process are synchronized and therefore controlled (7:59-61). While the nip rollers (109) used in Figure 1 are not disclosed as being driven nip rollers, other nip rollers in the process are disclosed as being driven nip rollers (8:11-17). ~~It would be obvious to one skilled in the art to use driven nip rollers for the nip rollers (109) to move the coated layer along the process in a synchronized and controlled manner to improve the quality of the product.~~ Kejha teaches that the current collectors described in US Patent Application serial number 08/281,011 may be used in the Patent 5,443,602 invention. (See US Patent 5,750,289, child of application 08/281,011, Col. 3, ll. 48-56). The metal grids, expanded metal foils, perforated metal foils, and solid metal foils recited in instant claims 28-31 are encompassed by the current collectors disclosed in US Patent application serial number 08/281,011. As disclosed by applicants, these current collectors include two or three layers of different materials including a plastic film or net layer, and one or two metal layers on the surface of the plastic. Thus, the current collectors disclosed in US Patent Application serial number 08/281,011 include a metal layer, which would be in the form of metal grid, expanded metal foil, perforated metal foil, or solid metal foil.

Kejha teaches a motor driven spool (5:14-20) but does not discuss the use of a slip clutch.

Brownrigg teaches an expanded metal grid used to make an electrode. The grid is pulled through a slurry of active material (dip-coated), therefore placing the grid in the middle of the electrode coating (Abstract; 5:1-12). A slip clutch is used to drive the nip rollers (3:35-52). The motivation to use the slip clutch is to insure uniform pulling force on the web, preventing a lag or break in the material, which would create a non-uniform electrode coating.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the driving motor of Kejha with the slip clutch of Brownrigg to provide a uniform driving force on the metal grid to insure an even coating of electrode material.

~~Kejha is silent to using nip rollers before the dip coating.~~

Chesnut teaches an apparatus for advancing strip material through another process. The strip material is fed off a roll by a metering roll and nip roller (Abstract; Fig. 1; 3:35-42, 3:55-67, 4:15-25, 4:45-60). The motivation to use the driven nip rollers to feed the strip material through a process is to provide precise and accurate advancement of the strip material. Furthermore, the machine is easily set up and permits changing parameters of the program sequence while in operation (2:15-25).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the coating apparatus of Kejha and Brownrigg with the driven nip rollers of Chesnut to feed the material through with precision and accuracy.

Applicant's position is that:

The Examiner's rejection of claims 28-31 based on obviousness of a combination of prior art Patents of Kejha, Brownrigg, and Chesnut is in error.

The instant invention is a great improvement over the prior art of Kejha, due to using very different drive system for controlling the speed of the coated web, which greatly effects the uniformity of thickness of the coating.

The major difference from the prior art is in controlling the web speed before the dip-coating, by using driven nip-rollers before the dip-coating.

(Sequential second step, line 4 of each claim 28-31).

Controlling the web speed before dip-coating provides for no fluctuation of the web speed, and the steady web speed is critical for achieving the uniform coating thickness.

Also, this way the nip-rollers do not touch the coating, and thus can not damage the coating layers. The winding of the web onto the spool by using an overdrive with a slip clutch is secondary.

The prior art of Kejha in FIGURES 4 and 5 controls the web speed by winding the web onto a spool, which

is constantly changing the diameter of the spool, and consequently the RPM of the spool must be constantly varied to compensate for this change, resulting in the web speed fluctuation and thus non-uniform thickness of coating.

The prior art of Brownrigg cited by the Examiner has a slip clutch driving the feeding nip rollers of the web into a grid stretching machine. Applicant's coater does not have a slip clutch for driving the nip-rollers to control the speed of the web, but it has a direct,

“hard” drive of nip-rollers, to ensure no slipping and thus no speed fluctuation, which is different from Browrigg.

The sequential steps of claims 28-31 are supported by the Specification Page 9, lines 20-25 and Page 10, lines 1-2 and 14-26, and Page 11, lines 12-13, and by Drawings FIGURE 1 and FIGURE 7.

The Examiner’s reference to Patent of Kejha, that the speed of all the components of the manufacturing process are synchronized and therefore controlled (column 7, lines 59-61) is in error. These lines describe a cells assembly machine FIGURE 8, not a coater.

Additionally, the reference to FIGURE 1 of Kejha’s Patent is also in error, because it is another cell assembly apparatus, not a coater. The rollers 109 are non-driven wipe rollers after dipping in an adhesive and do not control the speed of the web. Nothing in these references relates to the coating method of Applicants’.

The Examiner’s reference to the slip clutch of Brownrigg is also in error. Brownrigg’s machine is not a coater, but a grid stretching machine. The motivation of Brownrigg is to stretch the grid without breakage, not to wind the web on a spool.

Applicants do not claim to invent a slip clutch, which has many applications.

Applicant’s unique drive system with nip-rollers controlling the web speed before coating provides high quality coating of electrodes.

The Examiner’s reference to Chesnut’s apparatus is also in error. Chesnut’s apparatus is a punch press with a “stop and go” advancement system of material to be punched or stamped, not a coater of electrodes for electrochemical devices. There is no uniform, constant speed needed, just an accurate advancement, at any irregular speed to desired length, and then stop. (Advances and stops repeatedly).

Applicants believe, that the Examiner's combination of references is improper, and also because nothing in the reference cited by the Examiner suggests that they should be combined to provide uniform coating thickness of electrodes for lithium based electrochemical devices and capacitors, and that the Examiner's combination of references does not meet Applicable Court Standards.

THE APPLICABLE STANDARDS FOR
COMBINING REFERENCES UNDER SECTION 103

The Patent and Trademark Office must prove a prima facie case of obviousness of the claimed invention.

"One of the more difficult aspects of resolving questions of non-obviousness is the necessity 'to guard against slipping into the use of hindsight.'" In re Carroll, 601 F.2d 1184, 1186, 202 USPQ 571, 572 (CCPA 1979) (quoting Graham v. John Deere Co., 383 U.S. 1, 36 [148 USPQ 459,474] (1965)). The Patent and Trademark Office has the burden of showing that the prior art would have taught or suggested the claimed invention to one of ordinary skill in the pertinent art, In re Clinton, 527 F.2d 1226, 1228, 188 USPQ 365, 367 (CCPA 1976).

In re Shaffer, 108 USPQ 326, 229 F.2d 476 (CCPA) \ 1956) is one of many cases in which it is pointed out that for a combination of old elements to be patentable, the elements must cooperate in such manner as to produce a new, unobvious, and unexpected result, citing In re Kaufman, 39 CCPA (Patents) 769, 193 F.2d 331, 92 USPQ 141 and In re Lindberg, 39 CCPA (Patents) 866, 194 F.2d 732, 93 USPQ 23.

The Court in Shaffer said:

"Furthermore, as a general matter, in determining patentability, the concept of a new and useful improvement must be considered along with the actual means of achieving the improvement. In re Delancy, 34 CCPA (Patents) 849, 159 F.2d 737, 72 USPQ 477. In re Bisley, 39 CCPA (Patents) 982, 197 F.2d 355, 94 USPQ 80."

In determining obviousness it is necessary to determine whether the references themselves suggest the desirability of the proposed combination.

In re Bergel and Stock 292 F.2d 955, 956-7, 130 USPQ 206, 208 (CCPA 1961) and In re Grabiak 769 F.2d 729, 732, 226 USPQ 870, 872 (Fed. Cir. 1985).

And in In re Imperato, 286 F.2d 585, 179 USPQ 730 (CCPA 1973) it is stated:

"The mere fact that the disclosures of the prior art can be combined does not make the combination obvious unless the art also contains something to suggest the desirability of the combination. In re Bergel. supra."

See also Interconnect Planning Corporation v. Feil, 774 F.2d 1132, 1143, 227 USPQ 543, 551 (Fed. Cir. 1985).

Also, in In re Dow Chemical Co., 5 USPQ 2d 1529, (CAFC 1988) the Court said at page 1532:

"The PTO presents, in essence, an 'obvious to experiment' standard for obviousness. However, selective hindsight is no more applicable to the design of experiments than it is to the combination of prior art teachings. There must be a reason or suggestion in the art for selecting the procedure used, other than the knowledge learned from the applicant's disclosure."

Further, in In re Geiger, 2 USPQ 2d 1276 (CAFC 1987) the Court said at p. 1278:

"At best, in view of these disclosures, one skilled in the art

might find it obvious to try various combinations of these known scale and corrosion prevention agents. However, this is not the standard of 35 U.S.C. Sec. 103."

In order to establish a prima facie case of obviousness, the prior art teachings must be sufficient to suggest making the claimed apparatus. Here, there is no evidence of record which would have led one of ordinary skill at the time the invention was made to combine the prior art in the manner the Examiner proposes, to achieve applicants' structure.

There must have been a reason apparent at the time the invention was made to the person of ordinary skill in the art for applying the teaching at hand, in the manner proposed or the use of the teaching as evidence of obviousness will entail prohibited hindsight. In re Nomiya, 509 F.2d 566, 184 USPQ 607, 613 (CCPA 1975).

Obviousness is tested by "what the combined teachings of the references would have suggested to those of ordinary skill in the art." In re Keller, 642 F.2d 413, 415 208 USPQ 871, 881 (CCPA 1981). But it "cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination." ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984).

See also:

In re Donovan and Ryan, 184 USPQ 414 (CCPA 1975)

In re Regel, Buchel and Plempel, 526 F.2d 1399, 188 USPQ 136 (CCPA 1976)

Ex parte Shepard and Gushue, 188 USPQ 563 (1974)

In re Reinhart 531 F.2d 1048, 189 USPQ 143 (CCPA 1976)

In Ex parte Thompson, 184 USPQ 558, the board, in considering a Section 103 rejection stated that it would not be obvious to substitute an element of a first reference for an element of a second reference, since to do so would destroy the apparatus of the second reference for its intended purpose.

See also:

Ex parte Hartman, 186 USPQ 366 (1974)

In re Meng and Driessen, 492 F.2d 843, 181 USPQ 94 (CCPA 1974) states:

"As we said in In re Shuman, 53 CCPA 1251, 361 F.2d 1008, 1012, 150 USPQ 54, 57 (1966) references must be evaluated by ascertaining the facts fairly disclosed therein as a whole."

The CAFC in a recent case set forth the proper inquiry for evaluating references as:

References must be considered for all that they teach. W.L. Gore & Assoc. v. Garlock, Inc., 721 F.2d 1540, 1550, 220 USPQ 303, 311 (Fed. Cir. 1983) cert. denied, 469 U.S. 851 (1984).

See also In re Fritch, 23 USPQ 2d 1780 (CAFC 1992).

In combining references, the Examiner did not and could not:

1. Find any suggestion of the desirability of the proposed combination;

2. Find any suggestion for combining the references in the references themselves;

3. Find any suggestion in the references taken as a whole of the structure claimed;

4. Find the actual structure as claimed and employed to achieve a new and unexpected result.

Claim 5 describes a manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 28, in which said length of said grid is treated by a solvent resistant primer, prior to said dip-coating, which is supported by the Specification, Page 12, lines 18-27, and Page 13, lines 1-6.

Claim 6 describes a manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 29, or 30, or 31, in which said length of said foil is treated by a solvent resistant primer, prior to said dip-coating, which is supported by the Specification Page 12, lines 18-27, and Page 13, lines 1-6.

Claim 7 describes a manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 28, or 29, or 30, or 31, in which said slurry includes at least two solvents of different evaporation rate, an active material, a carbon black and a polymer binder, which is supported by the Specification Page 10, lines 1-8, and Page 11, lines 3-6.

Claim 8 describes a manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 7, in which said solvents include acetone in the range of 42 to 54 weight % (percent) and N-methylpyrrolidinone in the range of 6 to 23 weight % (percent), said polymer binder is polyvinylidene fluoride homopolymer in the range of 1 to 8 weight % (percent), said active material is in the range of 24 to 37 weight % (percent), and said carbon black is in the range of 1 to 8 weight % (percent), which is supported by the Specification Page 11, lines 17-27 and Page 12, lines 1-3.

Claim 10 describes a manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 5, in which said primer is a mixture of a carbon black and a solution of polyvinylidene fluoride homopolymer in at least two solvents, which is supported by the Specification Page 13, lines 1-3, and 11-15.

Claim 11 describes a manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 5, in which said length has masked areas of intended terminal tabs by solvent resistant adhesive tapes, prior to said primer treatment, and said adhesive tapes are removable, which is supported by the Specification Page 14, lines 1-8.

Claim 21 describes manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 6, in which said primer is a mixture of a carbon black and a solution of polyvinylidene fluoride homopolymer in at least two solvents, which is supported by the Specification Page 13, lines 1-3.

Claim 22 describes manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 6, in which said length has masked areas of intended tabs by solvent resistant adhesive tapes, prior to said primer treatment, and said adhesive tapes are removable, which is supported by the Specification Page 14, lines 1-8.

2. WAS THE EXAMINER'S REJECTION OF CLAIMS 5-8, 10, 11, 21 AND 22 UNDER 35 U.S.C. SECTION 103(a) AS OBVIOUS OVER KEJHA NO. 5,443,602; BROWNRIGG NO. 3,607,411; CHESNUT NO. 4,033,522; ANDERSON NO. 6,280,879 AND WERNER NO. 3,694,392 IN ERROR?

The Examiner's rejection of claims 5-8, 10, 11, 21 and 22 was in error.

The Examiner's position is that:

Claims 5-8, 10, 11, 21, and (22) are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 5,443,602 (Kejha), US Patent 3,607,411 (Brownrigg) and US Patent 4,033,522 (Chesnut) as applied to any of claims 28-31 above and further in view of US Patent 6,280,879 (Andersen).

The teachings of Kejha, Brownrigg and Chesnut as discussed above are incorporated herein.

Kejha also teaches attaching masking tape to the terminals of the current collector prior to further processing of the collector (3:45 – 4:30).

However, Kejha does not disclose application of a primer material to a current collector prior to dip-coating the current collector.

With regard to claims 5, 6, 10, 11-13 19, 21, and 22, Andersen teaches that current collector foils can be protected from highly reactive and corrosive electrode and electrolyte materials by coating the current collectors with primer. The primer is composed of carbon black, a binder (PVDF or PVDF copolymers), and solvent (multiple solvents used in Examples II and III). It was shown that the primer resulted in good

adhesion (5:27-6:23; 14:14-16). One of ordinary skill in the art at the time the invention was made would have known. Thus, it would have been obvious to one of ordinary skill in the art to use the primer disclosed by Andersen et al. in the process disclosed in by Kejha in order to protect current collectors from reactive and corrosive materials and promote good adhesion.

With regard to claims 7, 8, 21, and 22, Andersen teaches an electrode paste having solvent in the range of 20-88% by weight, binder in the range of 1-10% by weight, active material in the range of 25-50% by weight, and carbon black as a conductive additive in the range of 2-10% by weight. PVDF is a preferred binder, and ketones, which include acetone, and N-methyl-pyrrolidone are preferred solvents. (Col. 7, ll. 17-65). Adjustment of the boiling point/evaporation rate of the solvent and the viscosity of the solvent are taught as critical, and thus it would have been obvious to one of ordinary skill in the art to use a combination of solvents to adjust vapor pressure, etc.

Regarding the order of the steps involved, Kejha teaches masking off an area of the collector to protect the surface from any subsequent coatings so a clean surface is provided for further attachment means. Anderson teaches providing a primer coating on the collector to promote good adhesion.

Therefore, it would have been obvious to one skilled in the art at the time of the invention to mask off the areas of the collectors needing a clean coating free surface, as taught by Kejha, before coating the collector with the primer coating as taught by Anderson.

Applicant's position is that:

The Examiner's error in combining references of Kejha, Brownrigg and Chesnut is explained above for claims 28-31, and the argument is incorporated herein.

Applicants agree with the Examiner, that teaching of Andersen about the primer coating, solvents and electrode paste is known, but because the claims 5-8, 10, and 21-22 are dependent directly or indirectly on claims 28-31 with all their limitations, they should be allowed.

Claim 14 describes a manufacturing method for lithium based electrochemical devices and capacitors, as described in claim 5, in which said primer is a mixture of a solution of lithium polysilicate in water and a carbon black, and a said length is dip-coated with said primer and is sequentially pulled over a roller horizontally after dipping while hot air is applied on said coating, which is shown in FIGURE 7 and is supported by the Specification Page 13, lines 18-25.

Claim 23 describes a manufacturing method for lithium based electrochemical devices and capacitors, as described in claim 6, in which said primer is a mixture of a solution of lithium polysilicate in water and a carbon black, and a said length is dip-coated with said primer and is sequentially pulled over a roller horizontally after dipping while hot air is applied on said coating, which is shown in FIGURE 7 and is supported by the Specification Page 13, lines 18-25.

3. WAS THE EXAMINER'S REJECTION OF CLAIMS 14 AND 23 UNDER 35 U.S.C. SECTION 103(a) AS OBVIOUS OVER KEJHA NO. 5,443,602; BROWNRIGG NO. 3,607,411; CHESNUT NO. 4,033,522; ANDERSEN NO. 6,280,879 AND WERNER NO. 3,694,392 IN ERROR?

The Examiner's rejection of claims 14 and 23 was in error.

The Examiner's position is that:

Claims 14 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 5,443,602 (Kejha), US Patent 3,607,411 (Brownrigg), US Patent 4,033,522 (Chesnut) and US Patent 6,280,879 (Andersen), as applied to claims 5 & 6 and further in view of Werner (U.S. Patent No. 3,694,392).

The teachings of Kejha, Brownrigg, Chesnut and Anderson as discussed above are incorporated herein. Kejha also teaches pulling the grid over a horizontal roller after a dip coating process and passing the grid through a solidifying chamber (Figs. 1 & 8; 6:47-53). The solidification chamber can be any of a well-known type, like a drying chamber with infrared heaters and fans (4:56-60).

However, the references are silent to the primer containing lithium polysilicate and carbon black.

Werner teaches a primer for increasing adhesion of a fluorocarbon polymer coating to a substrate. This primer contains lithium polysilicate, carbon black and water (1:42-48; Example 1). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a primer containing lithium polysilicate, carbon black, and water as disclosed by Werner in the process disclosed by Kejha, Brownrigg, Chesnut and Andersen in order to increase adhesion of the dip-coated slurry to the current collector.

Applicant's position is that:

The Examiner's rejection of claims 14 and 23 based on obviousness of a combination of prior art Patents of Kejha, Brownrigg, Chestnut, Andersen, and Werner is in error.

Dependent claims 14 and 23 have a unique feature of pulling and drying the web immediately horizontally over a roller, after dipping, which is not described in prior art. (See Specification, Page 13, lines 16-25, and Drawing Fig. 7).

The word "sequentially" defines position of the roller.

The Examiner's reference to FIGURE 1 and 8 of Kejha's is in error, because these figures illustrate a cell assembly machine, not a coater. The webs 101 and 11 are pulled over a roller to adhesively join them together by bending, not to prevent the run off of the coating like applicants. (See Page 13, lines 18-25).

Applicants believe, that this invention embodies unique improvement of electrodes' primer coating over the prior art.

This is not taught by Andersen and Werner. Claims 14 and 23 are dependent on claims 5 and 6 and on independent claims 28-31 with all their limitations, as explained and argued above, which arguments are incorporated herein.

The Examiner in combining references did not meet the Applicable Court Standards above, and did not and could not:

1. Find any suggestion of the desirability of the proposed combination;
2. Find any suggestion for combining the references in the references themselves;
3. Find any suggestion in the references taken as a whole of the method claimed;
4. Find the actual method as claimed and employed to achieve a new and unexpected result.

Claim 12 describes a manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 28, or 29, or 30, or 31, which additionally includes an electrode cleaning step of removing said coating in the intended terminal tabs area by buffing and vacuuming after said coating.

Claim 13 describes a manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 28, or 29, or 30, or 31, which additionally includes an electrode cleaning step of removing said coating in the intended terminal tabs area by sand blasting and vacuuming after said coating.

4. WAS THE EXAMINER'S REJECTION OF CLAIMS 12 AND 13 UNDER 35 U.S.C. SECTION 103(a) AS OBVIOUS OVER KEJHA NO. 5,443,602; BROWNRIGG NO. 3,607,411; CHESNUT NO. 4,033,522 AND IWANAGA NO. 5,385,761 IN ERROR?

The Examiner's rejection of claims 12 and 13 was in error.

The Examiner's position is:

Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 5,443,602 (Kejha), US Patent 3,607,411 (Brownrigg) and US Patent 4,033,522 (Chesnut) as applied to claim 28, and further in view of U.S. Patent No. 5,385,761 (Iwanaga).

The teachings of Kejha, Brownrigg and Chesnut as discussed above are incorporated herein.

Kejha, Brownrigg and Chesnut are silent to an electrode-cleaning step.

Iwanaga teaches sandblasting to remove the mask after the electrode has been

coated (8:42-44). One of ordinary skill in the art would recognize that any abrading or polishing would remove the mask and any oxides that may have formed on the masked portion of the collector and would leave behind detritus. This detritus would adversely affect the joining of the current collector and terminal tab, thus requiring removal.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include an electrode cleaning step to remove the mask as taught by Iwanaga in the process as disclosed by Kejha, Brownrigg and Chesnut in order to remove the mask and any oxides that may have formed so that good physical and electrical connections may be made.

Applicant's position is:

The Examiner's rejection of claims 12 and 13 based on combining references of Kejha, Brownrigg, Chesnut, and Iwanaga, is in error.

Applicants claim additional cleaning step of removing the coating on electrodes in the area of intended terminal tabs by sand blasting or buffing and vacuuming, not removing a mask and oxides of Iwanaga. Therefore the reference to Iwanaga is in error. Iwanaga does not teach removing the active material coating from the web such as grids or foil, as described in claims 28-31, defended above. Additionally, in combining references, the Examiner did not meet the Applicable Court Standards above, and did not and could not:

1. Find any suggestion of the desirability of the proposed combination;
2. Find any suggestion for combining the references in the references themselves;
3. Find any suggestion in the references taken as a whole of the method claimed;
4. Find the actual method as claimed and employed to achieve a new and unexpected result.

Applicants' method of coating of electrodes for lithium based electrochemical devices and capacitors is quite different from the references cited by the Examiner. The Examiner's hindsight reasoning is merely an invitation to experiment.

In response to Examiner's conclusion of obviousness based on new ground(s) of rejection, applicants believe that it is based on improper references.

To select the right combination of components and to create an original feature for the purpose of a major improvement over prior art requires vision, imagination and inventiveness. Applicants' inventions as claimed can not be found on the record, as proposed, suggested or reduced to practice, before the time of the applicants' invention on March 8, 2001.

Accordingly, the decision of the Examiner in rejecting the claims 5-8, 10-14, 21-23, and 28-31 was in error and should be reversed.

In order to establish a prima facie case of obviousness, the prior art teachings must be sufficient to suggest the making of the claimed construction. Here there is no teaching or suggestion in the prior art of record and relied upon by the Examiner, in particular Kejha, Brownrigg and Chesnut, which would have motivated one of ordinary skill in the art, at the time the invention was made, to make the many and varied modifications in the manner the Examiner proposes to obtain applicants' method of coating and treatments.

There must have been a reason apparent at the time the invention was made to the person of ordinary skill in the art for applying the teaching at hand, in the manner proposed or the use of teaching as evidence of obviousness will entail prohibited hindsight. In re Nomiya, 509 F.2d 566, 184 USPQ 607, 613 (CCPA 1975).

"In proceedings before the Patent and Trademark Office, the Examiner bears the burden of establishing a prima facie case of obviousness based upon the prior art."

In re Piasecki, 745 F.2d 1468, 1471-2, 223 USPQ 785, 787-88 (Fed. Cir. 1984).

The Examiner has not satisfied this burden as he has not shown any objective teachings in the prior art, specifically Kejha, Browrigg and Chesnut, which would lead one of ordinary skill in the art to make manufacturing methods of electrodes for electrochemical devices, which result in higher uniformity of coating thickness, and higher conductivity of current collectors, at lower cost.

The Examiner has not shown that knowledge generally available to one of ordinary skill in the art would have lead that individual to obtain the methods as described,

Accordingly, the Examiner has failed to meet the burden of establishing obviousness and should be reversed.

CONCLUSION

The Examiner has not made a prima facie case of obviousness because methods of electrode coating as described having driven nip-rollers controlling the web speed before dip coating, and an overdrive with a slip clutch winding the web, are not called for or described in the prior art of Kejha, Brownrigg and Chesnut Patents.

In addition, nobody even remotely suggested or disclosed in the prior art, that the active material coating of the web can be removed by buffing and vacuuming in the intended area of the terminal tabs.

Moreover, any prima facie case has been rebutted by the showings made here.

It is believed that the claims define a new , useful , and unobvious invention.

Reversal of the Examiner's rejection and allowance of the claims is respectfully requested.

Respectfully submitted,

A handwritten signature in cursive script, reading "Joseph B. Kejha", written over a horizontal dashed line.

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CLAIMS APPENDIX

Claim 1 (canceled)

Claim 2 (canceled)

Claim 3 (canceled)

Claim 4 (canceled)

Claim 5 (previously presented) :

Manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 28, in which said length of said grid is treated by a solvent resistant primer, prior to said dip-coating.

Claim 6 (previously presented) :

Manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 29, or 30, or 31, in which said length of said foil is treated by a solvent resistant primer, prior to said dip-coating.

Claim 7 (previously presented) :

Manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 28, or 29, or 30, or 31, in which said slurry includes at least two solvents of different evaporation rate, an active material, a carbon black and a polymer binder.

Claim 8 (previously presented) :

Manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 7, in which said solvents include acetone in the range of 42 to 54 weight % (percent) and N-methylpyrrolidone in the range of 6 to 23 weight % (percent), said polymer binder is polyvinylidene fluoride homopolymer in the range of 1 to 8 weight % (percent), said active material is in the range of 24 to 37 weight % (percent), and said carbon black is in the range of 1 to 8 weight % (percent).

Claim 9 (canceled) :

Claim 10 (previously presented) :

Manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 5, in which said primer is a mixture of a carbon black and a solution of polyvinylidene fluoride homopolymer in at least two solvents.

Claim 11 (previously presented) :

Manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 5, in which said length has masked areas of intended terminal tabs by solvent resistant adhesive tapes, prior to said primer treatment, and said adhesive tapes are removable.

Claim 12 (previously presented) :

Manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 28, or 29, or 30, or 31,

which additionally includes and electrode cleaning step of removing said coating in the intended terminal tabs area by buffing and vacuuming after said coating.

Claim 13 (previously presented) :

Manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 28, or 29, or 30, or 31,
which additionally includes an electrode cleaning step of removing said coating in the intended terminal tabs area by sand blasting and vacuuming after said coating.

Claim 14 (currently amended) :

Manufacturing method for lithium based electrochemical devices and capacitors, as described in claim 5, in which said primer is a mixture of a solution of lithium polysilicate in water and a carbon black, and a said length is dip-coated with said primer and is sequentially pulled over a roller horizontally after dipping while hot air is applied on said coating.

Claim 15 (canceled) :

Claim 16 (canceled) :

Claim 17 (canceled) :

Claim 18 (canceled) :

Claim 19 (canceled) :

Claim 20 (canceled) :

Claim 21 (previously presented) :

Manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 6, in which said primer is a mixture of a carbon black and a solution of polyvinylidene fluoride homopolymer in at least two solvents.

Claim 22 (previously presented) :

Manufacturing method of electrodes for lithium based electrochemical devices and capacitors, as described in claim 6, in which said length has masked areas of intended terminal tabs by solvent resistant adhesive tapes, prior to said primer treatment, and said adhesive tapes are removable.

Claim 23 (currently amended) :

Manufacturing method for lithium based electrochemical devices and capacitors, as described in claim 6, in which said primer is a mixture of a solution of lithium polysilicate in water and a carbon black, and a said length is dip-coated with said primer and is sequentially pulled over a roller horizontally after dipping while hot air is applied on said coating.

Claim 24 (canceled)

Claim 25 (canceled)

Claim 26 (canceled)

Claim 27 (canceled)

Claim 28 (currently amended):

A manufacturing method of electrodes for lithium based electrochemical devices and capacitors, comprising the sequential steps of

providing a length of a metal grid,

feeding said length into a dip-tank at a controlled speed using driven nip-rollers before dip-coating said length with an active material slurry,

pulling said length vertically upward through a solidification chamber,

solidifying said length in said chamber, and

winding said coated length onto a driven spool using an overdrive system with a slip clutch.

Claim 29 (currently amended):

A manufacturing method of electrodes for lithium based electrochemical devices and capacitors, comprising the sequential steps of

providing a length of an expanded metal foil,

feeding said length into a dip-tank at a controlled speed using driven nip-rollers before dip-coating said length with an active material slurry,

pulling said length vertically upward through a solidification chamber,

solidifying said length in said chamber, and

winding said coated length onto a driven spool using an overdrive system with a slip clutch.

Claim 30 (currently amended):

A manufacturing method of electrodes for lithium based electrochemical devices and capacitors, comprising the sequential steps of

providing a length of a perforated metal foil,

feeding said length into a dip-tank at a controlled speed using driven nip-rollers before dip-coating said length with an active material slurry,

pulling said length vertically upward through a solidification chamber,

solidifying said length in said chamber, and

winding said coated length onto a driven spool using an overdrive system with a slip clutch.

Claim 31 (currently amended):

A manufacturing method of electrodes for lithium based electrochemical devices and capacitors, comprising the sequential steps of

providing a length of a solid metal foil,

feeding said length into a dip-tank at a controlled speed using driven nip-rollers before dip-coating said length with an active material slurry,

pulling said length vertically upward through a solidification chamber,

solidifying said length in said chamber, and

winding said coated length onto a driven spool using an overdrive system with a slip clutch.